

Thallium

CAS No. 7440-28-0

General Information

Elemental thallium is a blue-white metal found in small amounts in soil and in sulfide-based minerals. In the past, thallium was obtained as a byproduct of the smelting of other metals; however, it has not been produced in the United States since 1984. It is still used in small amounts in the electronics industry.

Thallium exposure occurs primarily from commercial processes such as coal-burning and smelting. In these and other sources, thallium is produced in fine particles

that can be absorbed by inhalation. Thallium is toxic in small amounts and may cause peripheral neuropathy and alopecia following chronic exposures. Intentional or accidental overdoses result in multiorgan failure, neurologic injury, and death. Accidental ingestion of thallium can occur by eating rat poison that contains water-soluble thallium salts. In the United States, thallium has been banned for use in rat poisons. Other abandoned uses have included thallium as a component of cosmetic depilatories and antifungal agents.

Workplace air standards for external exposure are generally established (OSHA, ACGIH). Chronic high-level exposures can cause gastrointestinal and neurologic symptoms. Evidence for the carcinogenicity of thallium

Table 27. Thallium

Geometric mean and selected percentiles of urine concentrations (in µg/L) for the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 6 and older	.167 (.157-.179)	.060 (.050-.070)	.100 (.090-.110)	.190 (.180-.200)	.280 (.270-.300)	.390 (.380-.410)	.450 (.420-.470)	2465
Age group								
6-11 years	.195 (.171-.222)	.080 (.060-.110)	.140 (.110-.160)	.210 (.160-.250)	.310 (.260-.330)	.400 (.340-.430)	.450 (.390-.520)	340
12-19 years	.186 (.164-.211)	.080 (.050-.090)	.130 (.110-.160)	.210 (.200-.240)	.280 (.260-.310)	.400 (.370-.450)	.470 (.420-.510)	719
20 years and older	.161 (.151-.172)	.040 (.040-.050)	.100 (.090-.120)	.190 (.180-.200)	.290 (.260-.300)	.390 (.360-.400)	.450 (.420-.470)	1406
Gender								
Males	.184 (.167-.203)	.060 (.040-.080)	.120 (.110-.140)	.220 (.200-.230)	.310 (.280-.330)	.400 (.380-.420)	.450 (.420-.480)	1227
Females	.153 (.141-.166)	.050 (.040-.050)	.090 (.080-.100)	.180 (.150-.200)	.270 (.250-.290)	.390 (.350-.410)	.460 (.420-.480)	1238
Race/ethnicity								
Mexican Americans	.167 (.153-.182)	.070 (.050-.070)	.120 (.090-.130)	.190 (.170-.210)	.270 (.250-.290)	.370 (.330-.410)	.440 (.390-.480)	884
Non-Hispanic blacks	.208 (.183-.235)	.070 (.060-.110)	.150 (.130-.160)	.220 (.210-.240)	.340 (.310-.370)	.450 (.400-.480)	.550 (.460-.610)	568
Non-Hispanic whites	.159 (.146-.174)	.050 (.030-.060)	.100 (.090-.120)	.180 (.160-.200)	.280 (.260-.310)	.380 (.350-.410)	.440 (.420-.480)	822

is inadequate or unknown (IARC, NTP, U.S. EPA). Information about external exposure (environmental levels) and health effects is available from ATSDR at <http://www.atsdr.cdc.gov/toxprofiles> and from the EPA IRIS Web site at <http://www.epa.gov/iris>.

Interpreting Urine Thallium Levels Reported in the Tables

Urine thallium levels were measured in a subsample of NHANES participants aged 6 years and older. Subsamples were randomly selected within the specified age range to be a representative sample of the U.S. population. Finding low amounts of thallium in urine does not mean that the level of thallium causes adverse health

effects. Urinary concentrations of 100 µg/L in asymptomatic workers (500 times higher than observed in this NHANES sample) are thought to correspond to workplace exposures at the threshold limit value of 0.1 mg/m³ (Marcus 1985). Brockhaus et al. (1981) studied 1,265 people living near a thallium-emitting cement plant in Germany. Nearby residents were exposed by eating garden plants on which thallium had been deposited. Seventy-eight percent of the urine specimens in that study contained > 1 µg/L, with concentrations ranging up to 76.5 µg/L. There was no increase in the prevalence of symptoms at levels < 20 µg/L and only a slight increase in neuroasthenic-type symptoms above 20 µg/L.

Previous studies have suggested that normal amounts of

Table 28. Thallium (creatinine adjusted)

Geometric mean and selected percentiles of urine concentrations (in µg/gram of creatinine) for the U.S. population aged 6 years and older, National Health and Nutrition Examination Survey, 1999-2000.

	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval)						Sample size
		10th	25th	50th	75th	90th	95th	
Total, age 6 and older	.158 (.149-.166)	.086 (.079-.092)	.121 (.115-.128)	.167 (.159-.173)	.223 (.213-.234)	.297 (.273-.318)	.366 (.333-.389)	2465
Age group								
6-11 years	.214 (.191-.239)	.127 (.113-.143)	.165 (.147-.183)	.222 (.196-.233)	.297 (.246-.341)	.372 (.318-.468)	.423 (.356-.600)	340
12-19 years	.140 (.126-.157)	.083 (.066-.093)	.116 (.104-.124)	.152 (.143-.161)	.200 (.181-.220)	.257 (.229-.285)	.308 (.256-.375)	719
20 years and older	.154 (.146-.163)	.085 (.076-.091)	.118 (.111-.127)	.164 (.155-.172)	.217 (.204-.231)	.283 (.265-.306)	.356 (.313-.395)	1406
Gender								
Males	.143 (.134-.154)	.078 (.067-.087)	.116 (.107-.123)	.154 (.147-.163)	.200 (.192-.211)	.265 (.252-.297)	.333 (.299-.359)	1227
Females	.172 (.161-.183)	.095 (.086-.103)	.129 (.118-.143)	.180 (.168-.194)	.244 (.227-.258)	.313 (.286-.364)	.377 (.356-.409)	1238
Race/ethnicity								
Mexican Americans	.154 (.144-.165)	.085 (.075-.092)	.117 (.103-.128)	.158 (.147-.174)	.213 (.200-.234)	.281 (.263-.304)	.343 (.306-.389)	884
Non-Hispanic blacks	.135 (.119-.153)	.069 (.057-.083)	.100 (.093-.109)	.138 (.130-.148)	.200 (.179-.215)	.278 (.241-.312)	.380 (.303-.431)	568
Non-Hispanic whites	.160 (.149-.171)	.088 (.077-.097)	.127 (.115-.137)	.172 (.164-.180)	.225 (.213-.240)	.297 (.269-.326)	.364 (.333-.384)	822

thallium in the urine should be $< 1 \mu\text{g/L}$ (Schaller et al., 1980; Brockhaus et al., 1981; Minoia et al., 1990), levels that are consistent with levels documented in this NHANES 1999-2000 subsample. Other population surveys have demonstrated urinary levels of roughly similar magnitude (White et al., 1998; Minoia et al., 1990; Paschal et al., 1998). The variation of urinary thallium levels across this NHANES 1999-2000 subsample was narrow, possibly indicating limited opportunities for exposure. Geometric mean levels of the demographic groups were compared after adjustment for the covariates of race/ethnicity, age, gender, and urinary creatinine. Urinary thallium levels were slightly higher for the 6-11-year-old group than for the other two age groups. Levels in Mexican Americans were slightly lower than in non-Hispanic whites. It is unknown whether differences between ages or races/ethnicities represent differences in exposure, body-size relationships, or metabolism.

Whether thallium at the levels reported here is a cause for health concern is not yet known; more research is needed. These urine thallium data provide physicians with a reference range so that they can determine whether people have been exposed to higher levels of thallium than those found in the general population. These data will also help scientists plan and conduct research about thallium exposure and health effects.